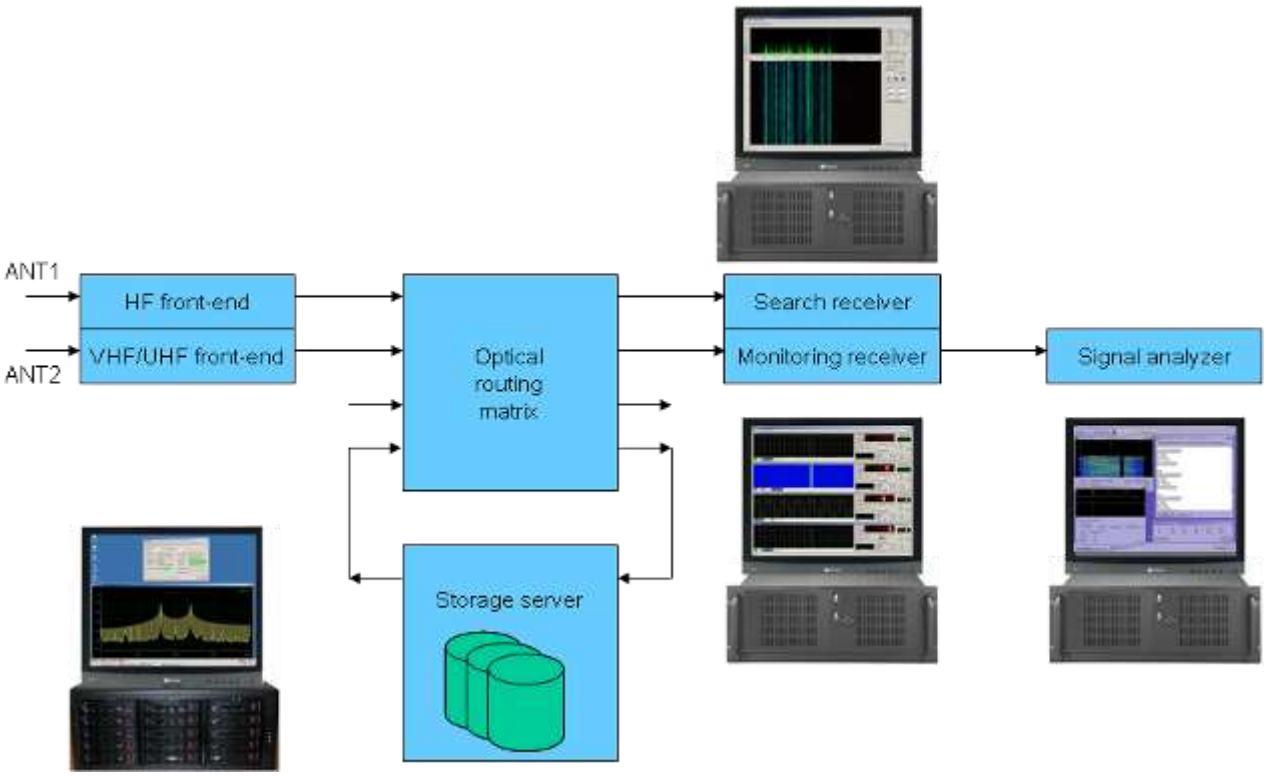
SAGAX Communications

Sagax - Signal Collecting System



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Description of the system

The system is a spectrum monitoring, signal analyzing and real-time electromagnetic scenario recording system for the HF, VHF and UHF range from 10 KHz up to 3GHz. The system is not only able to record complete communication scenarios with 20 MHz instantaneous bandwidth but capable to identify the transmission mode, bandwidth and other parameters of the emitting source as well. The identified source can be demodulated with the built in standard demodulators. If the transmission is a non-standard or coded, it can be further processed, analyzed with analyzing and decoding tools.

For the online analyzing the system contains fast scanning wide band search receiver, four-channel narrow band monitoring receiver and wide band storage server. The server is capable to store 40 MHz (Nyquist) bandwidth complete communication scenario with fine enough resolution to play back for off-line analyzing algorithm, whether it is in-built or third party.

The system is built from standard component, so it is easy to maintain and scale the capacity of the data acquisition part with added search, monitoring or storage capacity.

To achieve the necessary high speed the various components of the system are interconnected through optical fiber network. The center of the optical fiber network is a non-blocking routing matrix, which is able to route the signals between different components of the system (real-time or off-line soirces to the intercepting and monitoring receivers etc.)

Three types of work posts can be connected to the system for wide band search, narrow band monitoring/ recording and for real-time/off-line analyzing.

The system is built into a 12U, 19 inches rack with ruggedized notebooks on request for the work posts.

Main features of the system:

- Broadband 20-3000MHz front-end tuner with optical digitized output for VHF/UHF reception
- High-dynamic range 10KHz-32MHz HF receiver front-end with optical digitized output
- Fiber optic network for fast and reliable flow of data
- Real-time, 20GHz/sec fast scanning of the selected spectrum through the entire operation band from 10KHz to 3000MHz
- 4-channel (within the same frequency window of the front-end) narrow band monitoring receiver
- High capacity fast and reliable 40 MHz bandwidth server to record the complete spectrum of the entire front-end band band. The same server can play back the recorded spectrum later for off-line analyses.
- The system offers the same functionality for on-line analysis as for off-line (played back) analyses.

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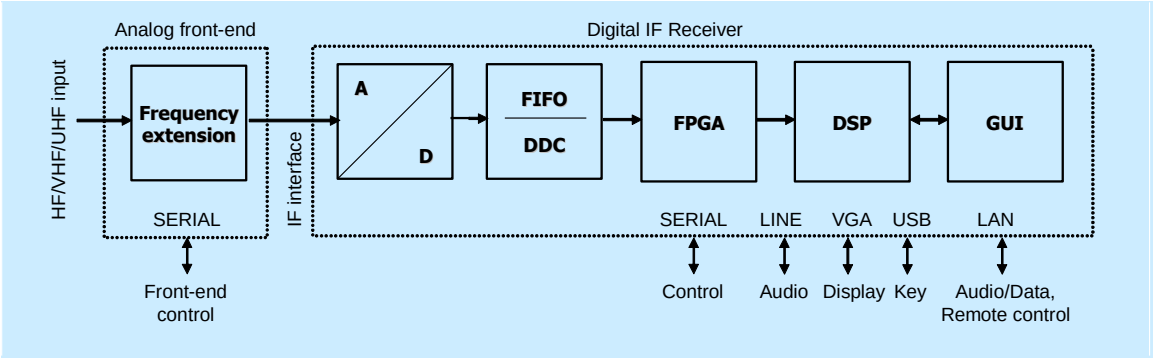
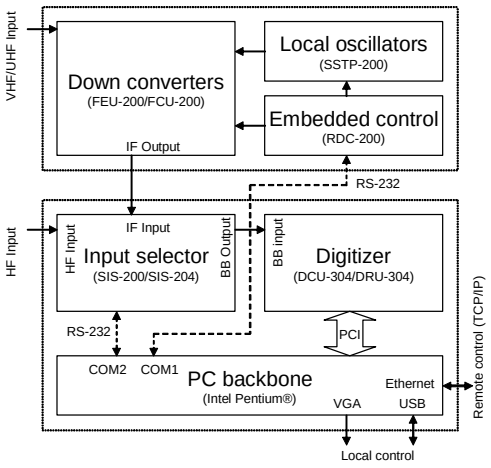
Software defined (SDR) radio technology

Our digital receiver concept based on the Software Defined (SDR) technology, which means to digitize the data as earlier in the signal path as possible and do all of the functionality in digital domain. Before the analog to digital conversion the required analog signal processing contains band limiting and pre-selection, variable amplification and frequency conversion in higher VHF/UHF bands. After the digitization burst memory (FIFO) or digital down-converter (DDC) is used depending on the application which could be a wide-band scanning or narrow-band monitoring reception. Programmable logic (FPGA) is used for on-board data processing and routing before the data is passed to digital signal processing (DSP) algorithm. The whole receiver is handled trough graphical user interface (GUI) which is running on the platform computer. External connections are provided by the platform computer for local and remote control.



High-tech hardware implementation

We use the latest state of the art analog processing and digital conversion technology available in the market to provide high-dynamic range, wide-bandwidth front-ends and digitizers for our receivers with 14/16bit resolution and 80/100MHz sampling rate. All of our digital signal paths are designed for 16/24bit sample handling.



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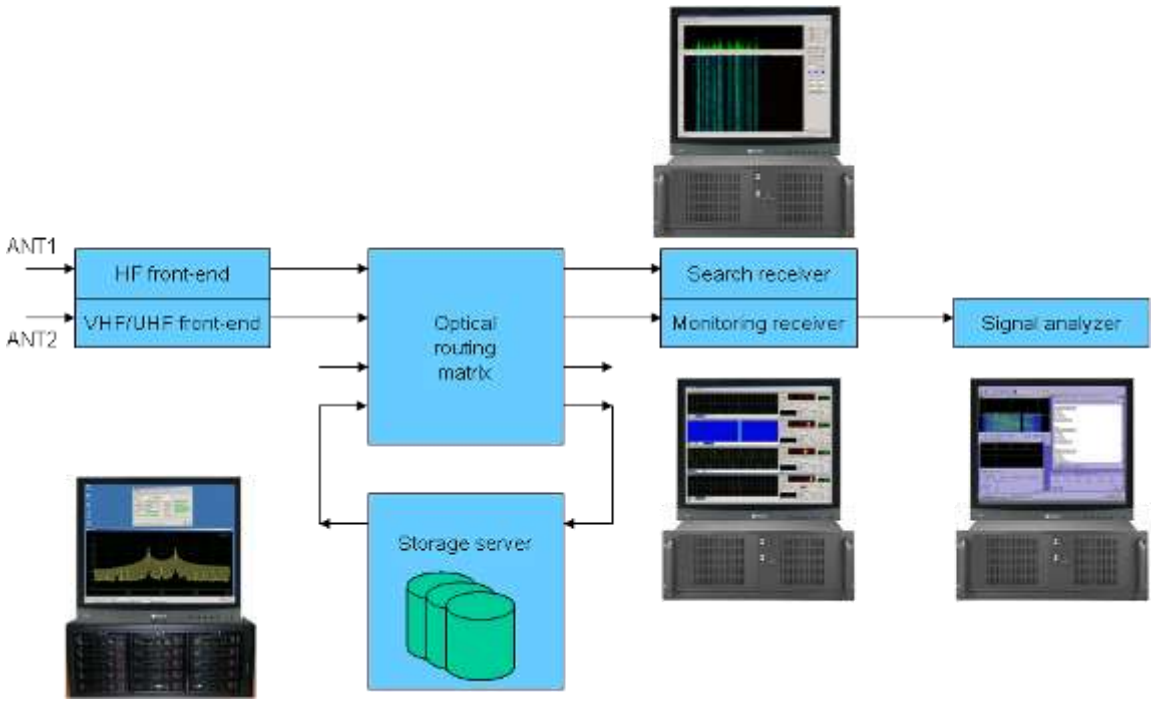
Configuration of the system

Schematic diagram of the system



Standard components used in the system:

1pc HF active antenna
1pc VHF/UHF antenna
1pc STR-3000 VHF/UHF front-end tuner (Cosmus)
1pc SIS-300 HF front-end
1pc SDS-100D-4-4 digital optical matrix
1pc SSS-3000 storage server
1pc SRS-3000 search receiver (Protus)
1pc SRM-3000 monitoring receiver (Quadrus)
1pc SDW-3000 demodulator and decoder (Centurion)

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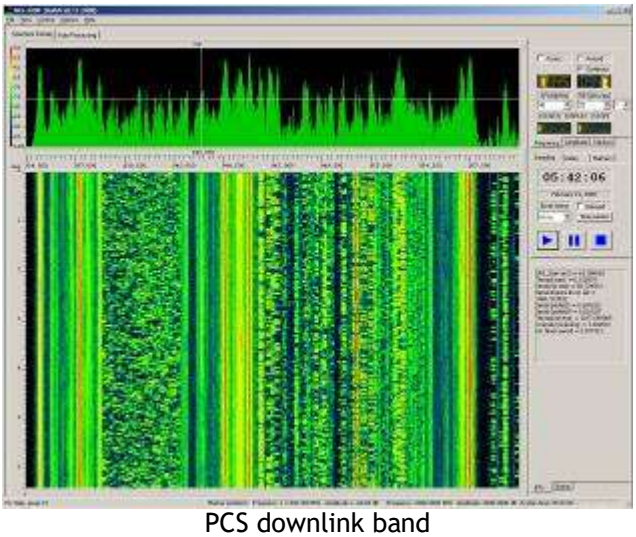
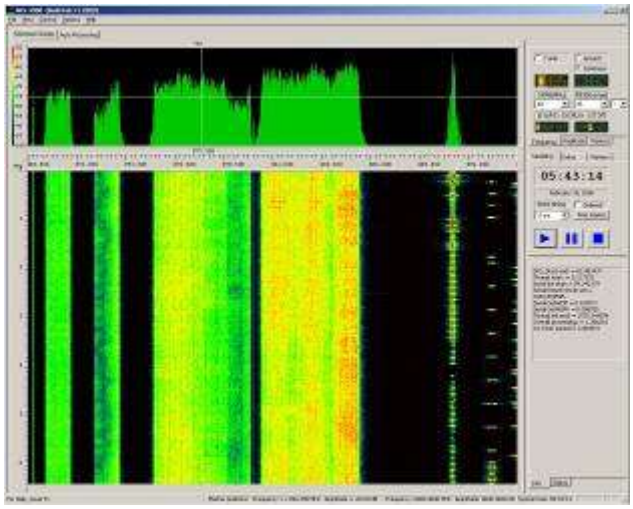
Online signal acquisition and analyses

Main features of the wide band search capability

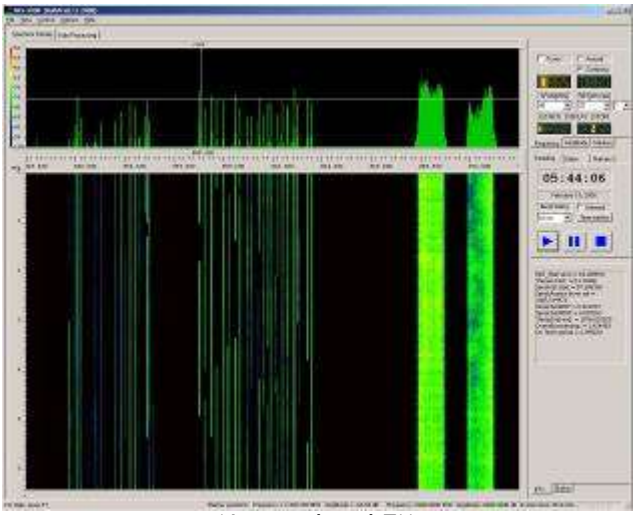
- Visualization of short-time spectra and panorama display,
- Digitally reducible bandwidth and high frequency resolution,
- Decrease of amplitude, frequency and time marker.
- Down to 1ms time resolution, down to 1kHz frequency resolution
- Quasy real-time frequency spectrum by complex FFT algorithms,
- Excellent instantaneous dynamic range,
- High adjacent-channel suppression
- Excellent precision and sensitivity
- Raw data recording (option), Signal pre-classifier (option



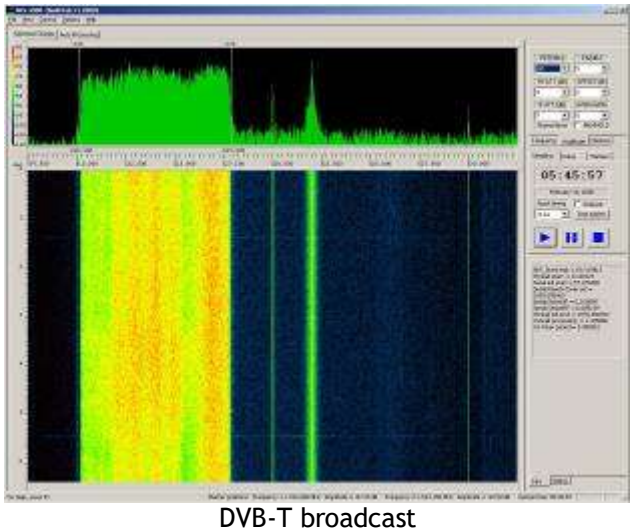
PCS downlink band



CDMA channels



Narrow-band FM



DVB-T broadcast

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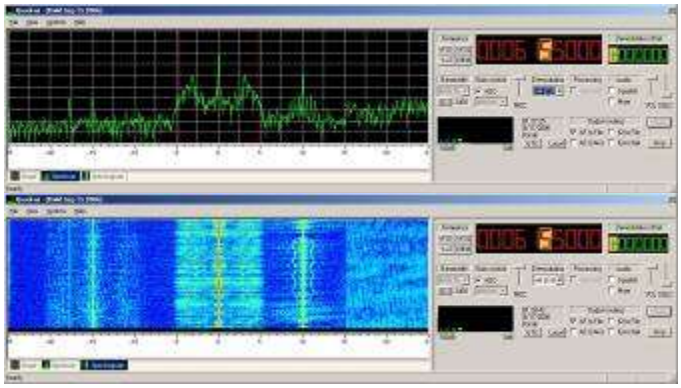
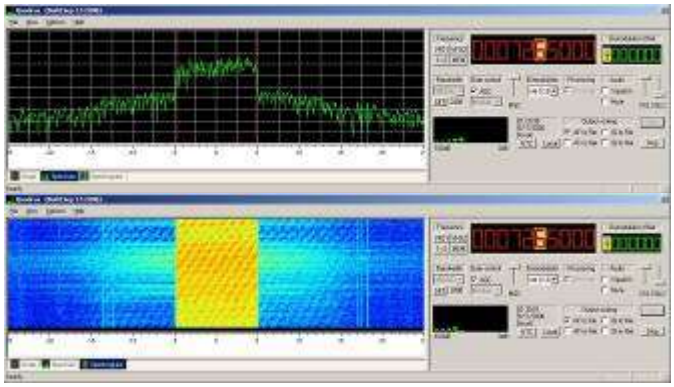
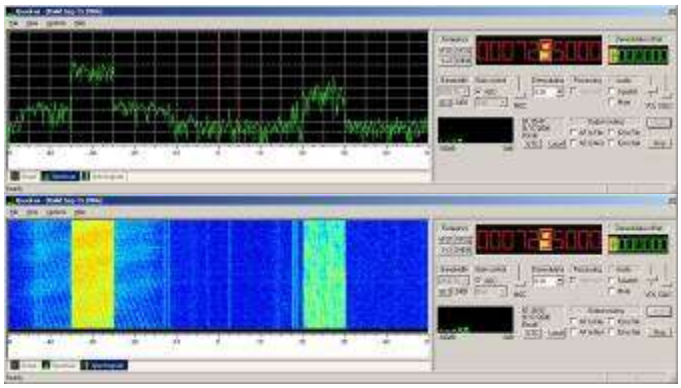
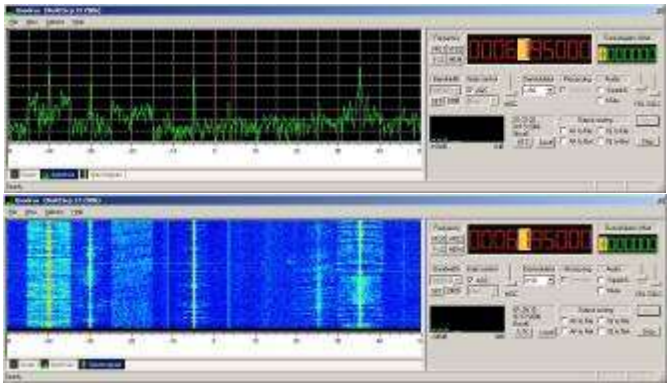
Narrow band monitoring and on-line analyzing capability

- Compact design with graphical user interface
- Up to 40MHz wide instantaneous real-time bandwidth
- Real-time IF panorama display by complex FFT algorithm
- Narrow-band analysis of analog modulated signals with demodulation
- Audio, IF and IQ output/recording of the signal,
- Excellent instantaneous dynamic range
- High channel selectivity by digital filtering
- Excellent precision and sensitivity
- Flexible compatibility for system integration
- Raw data recording (option)
- Signal pre-classifier (option)
- Direction finding (option)

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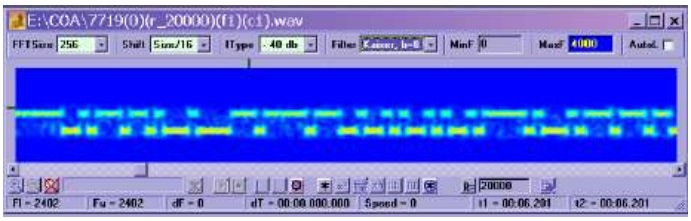
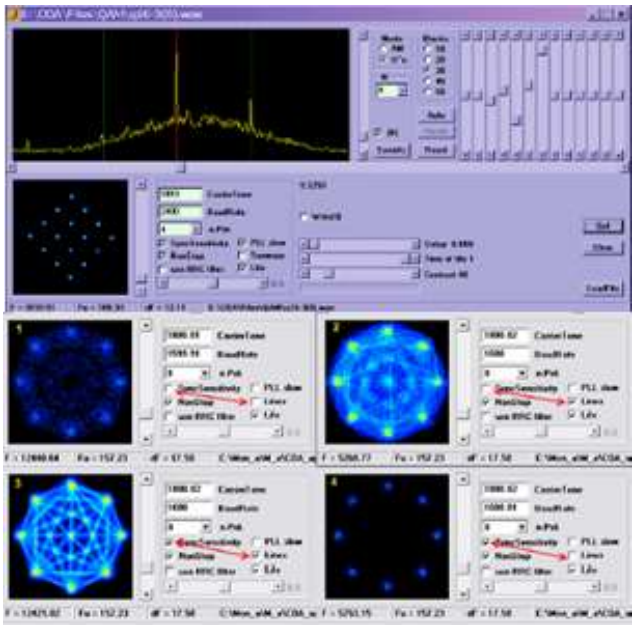
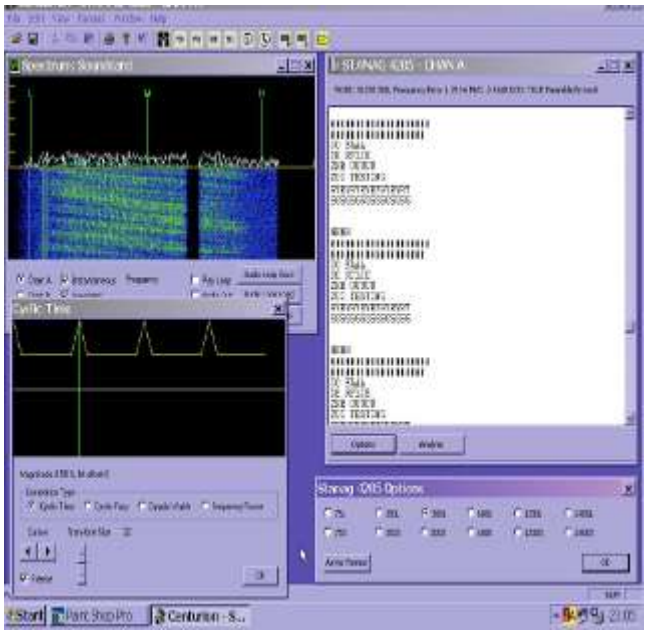
Versatile analysis offers the following functions

- interactive modulation type analysis
- automated modulation type classification
- demodulation and decoding of digitally modulated signals
- bit stream analysis
- Signal generator
- OFDM signals (recognition, demodulation, generation)
- Special modems: Pactor-, Codant-variants
- Speach-signal recognition
- Speach signal enhancement
- Instantaneous magnitude
- Instantaneous frequency
- Instantaneous phase
- Constellation diagram







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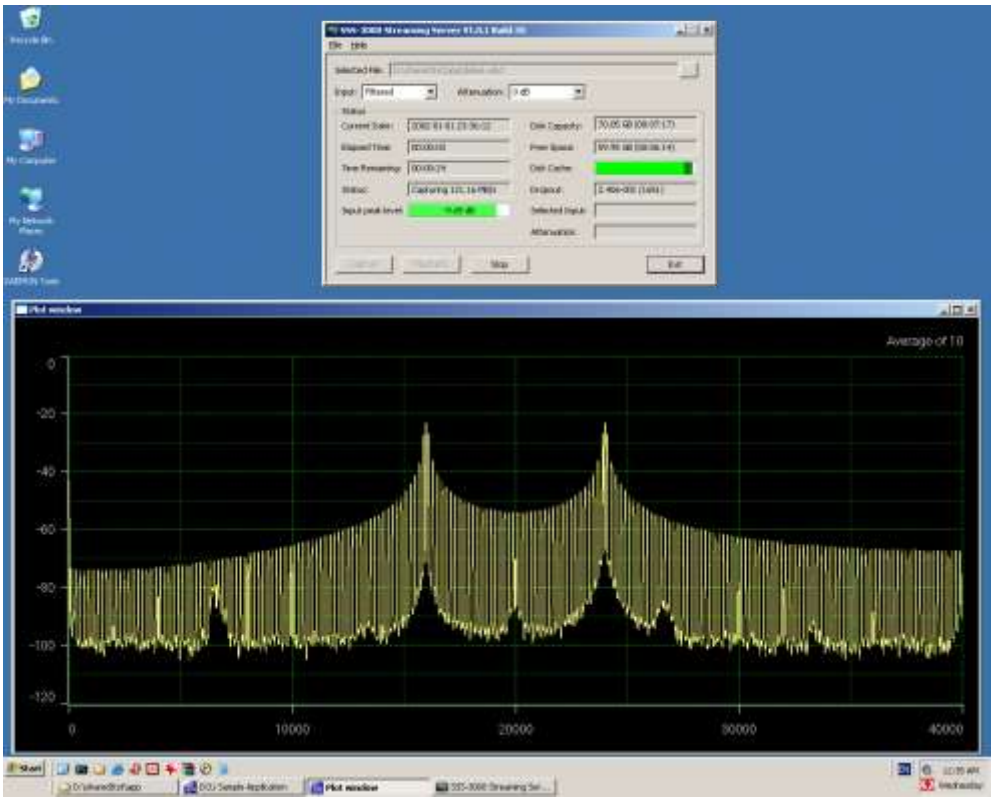
Main features of the long time recording of wide band signals:

- Compact design with easy to use graphical user interface
- Up to 40MHz wide instantaneous real-time bandwidth
- Digitally selectable recording bandwidth with tunable center frequency
- Analog or digital input and output
- Up to 8TB storage capacity in 4U
- Removable drives in 4U rack-mount units
- Stand-alone or network access
- Flexible compatibility for system integration



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